



Pan-european assessment, monitoring, and mitigation Of Stressors on the Health of BEEs

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<https://ec.europa.eu/eip/agriculture/en/find-connect/projects/pan-european-assessment-monitoring-and-mitigation>

Geographical location:

United Kingdom

Main geographical location (NUTS3):

West Surrey

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Fertilisation and nutrients management

Biodiversity and nature management

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Project Identification:

Multi-actor project

Project type:

Research project

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2018

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2023

Project status:

Ongoing

Website:

<http://poshbee.eu>

Title (in English):

PoshBee: Pan-european assessment, monitoring, and mitigation Of Stressors on the Health of BEEs

Objective of the project (native language):

See objectives in English

Objective of the project (in English):

PoshBee is a multi-actor, trans-disciplinary project whose overarching goal is to significantly enhance the sustainable health of bees and pollination services in Europe. The project will: 1) provide the first pan-European quantification of the exposure hazard of chemicals to managed and wild bees; 2) determine how chemicals alone, in mixtures, and in combination with pathogens and nutrition, affect bee health; and 3) through interactive innovation meet the demand-driven need for monitoring tools, novel and innovative screening protocols, and practice- and policy-relevant research outputs to local, national, European, and global stakeholders.

Description of activities (native language):

See description in English

Description of activities (in English):

PoshBee will determine the exposure of honey bees, bumble bees and solitary bees to agrochemicals across Europe. It will combine these profiles with data on pathogen prevalence and nutritional state to explain how chemical exposure affects bee health. Through laboratory, semifield and field experiments the project will determine the ecotoxicology and causal effects of chemicals, both single and mixed, on bee health for exemplar managed and wild, social and solitary bees. Finally, the project will develop new protocols for ecotoxicological studies of bees and new tools and models to monitor exposure and predict the effects of chemicals, pathogens, and nutritional stress in bees in the wild.

Short summary for practitioners

Practice abstract 1

Short title (native language):

PoshBee: pan-European assessment, monitoring, and mitigation of stressors on the health of bees

Short summary for practitioners (native language):

Bees - honey bees, bumble bees, and solitary bees - pollinate our crops and wildflowers, and thus are essential for human well-being. However, in Europe, and around the globe, bees face many threats and are often in decline as a result. One potential driver of reduced bee health is agrochemicals. While laboratory and semi-field studies suggest that such chemicals negatively impact bee health, their importance and relevance in the real world remains unclear. PoshBee (www.poshbee.eu [1]) is a consortium of academics, governmental organisations, industry, and NGOs that will address the issue of agrochemicals to ensure the sustainable health of bees and their pollination services in Europe. Integrating the knowledge and experience of local beekeeping and farming organisations and academic researchers, we will provide the first comprehensive pan-European assessment of the exposure hazard of chemicals, their mixtures, and co-occurrence with pathogens and nutritional stress for solitary, bumble, and honey bees across oilseed rape and apple orchards. Integrated studies across the lab-to-field axis will determine the effect of chemicals, their mixtures, and interactions with pathogens and nutrition on bee health. We will develop new model species and innovative protocols for testing chemicals in bees, and develop dynamic landscape environmental risk

assessment models for bees. Using proteomics, we will produce new molecular markers for assessing bee health and enabling long-term monitoring schemes. We will deliver practice- and policy-relevant research outputs to local, national, European, and global stakeholders. Our work will support healthy bee populations, sustainable beekeeping, and sustainable pollination across Europe.

Practice abstract 2

Short title (native language):

Pan-european assessment, monitoring, and mitigation of stressors on the health of bees (PoshBee)

Short summary for practitioners (native language):

Many recent reports describe long-term declines in insects. 'PoshBee' aims to identify factors negatively impacting bees in European farmland, and in 2019 performed an extensive pan-European field study over 8 countries. Our recommendations for groups planning to perform similar multi-partner, farm-scale, field studies on pollinating insects are listed below.

Scientists

- Accept variation will occur among partners, but record appropriate data to be used as covariates in subsequent data analysis
- Ensure all methodological protocols are understood and are practicable for all partners
- If specialist techniques are needed, hire staff familiar with these processes or ensure staff have adequate training
- Unless additional resources are available (staff/vehicles/funding), avoid adding extra 'side projects' out of scope of the main project

Beekeepers

- Standardize study hives in terms of equipment, colony size etc. If possible, obtain colonies from a single source
- Beekeepers should request clear guidelines on all aspects of hive management, and what records should be maintained
- Beekeepers should maintain regular contact with project management and communicate which procedures have been performed and any pests and diseases that have been observed

Farmers

- Growers/ field sites should be located early in the planning process
- Researchers should explain what they plan to do and when, and how the farmer can help throughout the study. Farmers should explain what they require so that farm operations are not negatively impacted by the research program
- Farmers should ask what information relating to the field site and crop management is required by the research team, and then maintain appropriate, easily accessible records

Practice abstract 3

Short title (native language):

Effect of real-world clothianidin exposure on bees and their diseases

Short summary for practitioners (native language):

In this study we used 16 commercial oilseed rape fields across southern Sweden to investigate the effect of real-world clothianidin exposure on bees. Half of the fields were sown with clothianidin-treated oilseed rape seed and half with clothianidin-free seed. Honeybee and bumblebee colonies as well as mason bee cocoons and nests were placed at each field and monitored during the growing season, with the honeybee colonies also monitored the following year through a second season of clothianidin exposure in oilseed rape. Chemical analysis of the nectar and pollen collected by the bees showed large differences in clothianidin exposure between treated and untreated fields, and between the two seasons. Honeybee colony growth and development was not affected by clothianidin exposure, but both bumblebees and mason bees produced far fewer offspring at treated fields than at untreated fields. Follow-up analyses showed that clothianidin exposure had no effect on pathogen levels in either honeybees or bumblebees, nor on immune genes in honeybees. The conclusion is that honeybee colonies are relatively robust to neonicotinoid exposure in agricultural landscapes, but that bumblebees and solitary bees are strongly affected.

For farmers:

If wild pollinators and their pollination are important for you or your neighbours, consider adjusting your plant protection strategy to reduce pesticide use, particularly in flowering crops and during bloom. For honeybees this would also be beneficial, but less critical.

<https://www.youtube.com/watch?v=mlgxa7lOjdQ> [2]

www.nature.com/articles/nature14420 [3]

www.nature.com/articles/s41467-018-07914-3 [4]

www.nature.com/articles/s41467-019-08523-4 [5]

Practice abstract 4

Short title (native language):

Teamwork of scientists and beekeepers in the field

Short summary for practitioners (native language):

As part of a European-wide experiment to assess the exposure of bees to environmental stressors, we were involved in the pre- and post-project consultation for the delivery of honey bees, their care, sampling support and consultation for questions on the oil seed rape field areas.

Based on our experience we make the following recommendations:

- before the project starts it should be clear that there is enough time planned for the bees to be purchased.

- that for NGO partners or beneficiaries that have not previously been involved in an EU project, a fixed contact person for all EU formalities should be in place at a project partner who already has this knowledge.
- the use of an additional communicator on the part of the beekeepers to support the conduct of the experiment. This communicator is intended to facilitate communication between the scientific community and the beekeepers, specifically to query all parties involved in small time windows. In everyday life, the worlds of beekeepers and scientists are too different to notice discrepancies which might have negative impacts on the study early enough. To clarify, we present two examples of such issues:
 - a) it would prevent agreements in the field from being postponed and forgotten until one of the parties remembers too late.
 - b) to prevent the misalignment of biological reality and study design. For example, scientists want to take samples (e.g., honey) within a specific time (e.g., 3 weeks) and avoid hives swarming, while the beekeepers know that hives will swarm within 3 days, or immediately if honey is harvested. Without timely communication, neither party understands the issues.

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Further details

Audiovisual material:

[Brochure](#) [48]

[Poster](#) [49]

[Infographic - project overview](#) [50]

[Press release](#) [51]

Description of the context of the project:

Bees - honey bees, bumble bees, and solitary bees - pollinate our crops and wildflowers, and thus are essential for human well-being. However, in Europe, and around the globe, bees face many threats and are often in decline as a result. One potential driver of reduced bee health is agrochemicals. While laboratory and semi-field studies suggest that such chemicals negatively impact bee health, their importance and relevance in the real world remains unclear. Chemicals are an integral feature of modern agriculture, controlling pests and disease in crops and domesticated animals. However, agrochemicals can also have negative effects on non-target organisms, with ensuing environmental costs [Hallmann et al. 2014]. The potential effects of agrochemicals on bee health is a high profile, yet unresolved case [Godfray et al. 2015], as bees provide the essential ecosystem service of pollination, but are at risk around the globe [Potts et al. 2016, Vanbergen et al. 2013]. Previous research has shown that agrochemicals affect behaviour, immunity, lifespan, physiology, and reproduction of individual bees and colonies, in honey bees, bumble bees, and solitary bees [Godfray et al. 2015, Tsvetkov et al. 2017, Woodcock et al. 2017], and that this may reduce pollination efficiency [Stanley et al. 2015].

Additional information:

Specific Objectives:

1. Exposure hazard: drawing on the complementary expertise of a diverse range of actors, we will quantify the exposure of honey bees, bumble bees, and solitary bees to chemicals within major agricultural cropping systems across Europe.
2. Ecotoxicokinetics: through the development of innovative protocols and novel model systems, co-created with end-user partners, we will assess toxicity and dynamics of key agrochemicals, and their mixtures, in honey bees, bumble bees, and solitary bees.
3. Health effects: taking a trans-disciplinary approach, we will integrate across laboratory, semi-

field, field, and landscape studies to provide a holistic understanding of how chemicals, their mixtures, and their interactions with pathogens and nutrition drive health in honey bees, bumble bees, and solitary bees.

4. Modeling bee health: PoshBee will develop the first mechanistically-underpinned holistic model of bee health.

5. Monitoring tools and protocols: we will provide validated tools for the monitoring and assessment of bee health and exposure to stressors. We will develop and test an innovative 'air sensor' tool for assessing chemical exposure within honey bee hives. Using proteomics, we will produce a novel molecular monitoring tool, or 'health card' for bees, that measures chemical exposure, pathogens, immune capacities, and nutritional state.

6. Driving policy and practice: PoshBee will develop a European bee health knowledge exchange hub by working together with key stakeholders in the honey bee, agrochemical, farming, pollination service, research, EU policy and regulatory, and bee conservation sectors.

Links

- [1] <http://www.poshbee.eu>
- [2] <https://www.youtube.com/watch?v=mlgxa7lOjdQ>
- [3] <http://www.nature.com/articles/nature14420>
- [4] <http://www.nature.com/articles/s41467-018-07914-3>
- [5] <http://www.nature.com/articles/s41467-019-08523-4>
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- [49] http://poshbee.eu/getatt.php?filename=PoshBee%20Poster_FP_1605.pdf
- [50] <http://poshbee.eu/about>
- [51] https://www.eurekalert.org/pub_releases/2018-08/pp-ama082718.php